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THE HARMONIOUS NON-SYMMETRICAL ACTION OF THE OBLIQUE MUSCLES EXPLAINS "BINOCULAR ASTIGMATISM."

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At the meeting of the section of ophthalmology, American Medical Association, in Cincinnati last May, Dr. Culbertson read his paper on "Binocular Astigmatism," which has since been published in the AMERICAN JOURNAL OF OPHTHALMOLOGY, vol. V., No. 5, p. 117. During that meeting I discussed his paper, supposing that what I was saying was being noted by our shorthand reporter for publication in the Journal of the Association, in connection with Dr. C.'s paper. The reporter failed to get any of the discussions of that meeting in a shape worthy of preservation, so that all was lost save to those who heard. I am not sorry on account of the loss of my discussion of Dr. C.'s paper, for the limited time, though kindly extended, was not sufficient for a clear exposition of what he had termed "Binocular Astigmatism."

The phenomena suggesting to him the subject on which he wrote were: imperfect vision, proximal and remote; distortion of a rectangle (3x12 inches) at a distance of one metre or less; and inclination of a level surface, as the floor, all of these being caused by the use, in binocular vision, of cylindrical lenses that had been carefully adjusted in monocular examinations. That these phenomena do occur in some cases of astigmatism has been observed by every ophthalmic surgeon of any experience; but I presume that Dr. C. is almost alone in the practice of changing the axis of the cylindrical glass for one eye (sometimes for both) in order that these phenomena may be made to disappear. That such practice was ever entirely satisfactory is but evidence of the self-adjusting power possessed by eyes, as well as their power of endurance. That lenses so changed would be better than no glasses at all, I can understand. That he ever found the changing of one axis better than the changing of both is strange, for reasons that will be given further on in this paper. That in one case he would have to change the axis of the right glass and in another the axis of the left is susceptible of explanation which will be given further on. That the changing of either axis is bad practice I will be able to prove.

For the phenomena referred to above, observed by many for years, no attempt at an explanation had been published, so far as I know, previous to Dr. Culbertson's paper; yet the true cause of all these phenomena, viz., *the rotation of the eyeballs by the harmonious non-symmetrical action of the oblique muscles* was discovered by myself more than three years ago, which discovery I set forth in a paper read in the Ophthalmic Section of the American Medical Association, at its meeting in Chicago in June, 1887, and published in the Journal of the Association, Nov. 5, 1887. Although that paper occupied more than the allotted time, I regret that I did not refer to these phenomena specifically, as it would have demonstrated better than anything else the correctness of the theory of rotation advocated in it.

There can be but three explanations for these phenomena,

and of these three there can be but one correct. The first (because I shall examine it first) is Dr. Culbertson's theory of rotation of the eyeballs by the recti muscles; the second, Martin's theory of sectional contraction of the ciliary muscles; and the third, my own theory of rotation of the eye-balls by the harmonious non-symmetrical action of the oblique muscles.

1. Dr. Culbertson's theory—what is it? Let me quote from his paper (p. 118): "But it is evident that in proximal vision the interni, the inferior oblique, and the superior and inferior recti muscles must exercise increased force and act in concert." In criticism of this statement I would say that the acting extrinsic muscles of the eyes in near vision are the interni, the inferior recti and the superior oblique, the interni causing the visual axes to converge, the inferior recti causing those axes to point downward toward the page, and the superior oblique preventing the loss of parallelism between the vertical meridians of the corneæ, which would occur if the inferior recti were unopposed in their action. In proximal vision only these muscles act, except in certain cases of astigmatism when, for the betterment of vision, the superior oblique of one eye is made to act too powerfully, rendering it necessary for the inferior oblique of the opposite eye to act correspondingly, in order to prevent double vision. *The naturally vertical meridians must be kept parallel if not vertical, else double vision would result.*

Again (p. 119): "Let the following case illustrate. In binocular proximal vision, suppose that the left inferior oblique fails to act sufficiently to maintain the axis of rotation vertical, and that the inner fibres of left superior rectus inclines said axis at its upper extremity toward the nose; then the rays of light will no longer cut the cornea in its vertical meridian, but toward the temporal side of the should-be vertical plane of the cornea. If the defective axis of the cylinder was at an angle of 180° in remote vision, for proximal vision the axis of the glass will have to be turned upward toward the displaced axis of rotation of the eye-ball, as many degrees as this axis has deviated from the normal vertical perpendicular. If

it be 10° then the angle would be 10° instead of 180° for the cylinder, the scale running from the temporal side. In other words the measure of deviation of the axis of rotation is the number of degree of axis-displacement of the cylinder required in order to cause both sides of our object board to appear parallel."

In criticism let me say: If the language just quoted is correct, the patient, in reading, must have held his book above his head, since contraction of the superior rectus would cause the axis of vision to point upward; or if looking at the rectangle that, too, must have been held above his head. Granting that the doctor intended to say inferior rectus instead of superior, and superior oblique instead of inferior, what would have happened? In either case *parallelism* between the naturally vertical meridians would have been lost, and *double* vision would have resulted, one image, if board was used, being a perfect rectangle as seen by right eye, while the other image would have been a four-sided figure, leaning and narrowed at one end. Moving the axis of his cylinder would have widened the end, but the image would still lean, and vision would still be double. Possibly the confusion of double images would have been so great that the deformity of one image would not have been noticed.

What the doctor names "binocular astigmatism" cannot be caused by what he would term "unbalanced action" of a rectus and oblique muscle of one eye, the action of these muscles in the other eye being perfectly balanced. Can it be caused by the "unbalanced action" of the inferior recti and superior oblique, or, if the card-board is held above the head, the superior recti and inferior oblique of both eyes? If the inferior rectus of right eye is not sufficiently opposed by its superior oblique, the former will so rotate the eye as to make the upper end of the vertical meridian of its cornea (the meridians of the cornea end at corneal margin, therefore I may say "end of meridian") point up and out; if the inferior rectus of the left eye is not sufficiently opposed by its superior oblique, then the former will cause its eye to so rotate as to make the upper end

of its vertical corneal meridian point up and out. This would make the naturally vertical meridians of the corneæ divergent at upper corneal margin and convergent below. Marked double vision would result, the two images of a vertical object, leaning toward each other at their tops. If we could suppose that double vision would not result, the image of the object looked at through the glasses as adjusted in the monocular examinations, if a rectangle, would be narrow at the top and wide at the bottom, a phenomenon not referred to by Dr. Culbertson.

It is clear that the explanation for "binocular astigmatism," as given by Dr. Culbertson, is not correct.

2. Toward the close of his paper (p. 123) Dr. C. says his explanation may not be true, and adds: "Accommodation may have a direct influence in the result, by changing the focus of individual sectors of the crystalline lens," referring to Martin's theory of the sectional contraction of the ciliary muscle.

The fact that "binocular astigmatism" exists to some extent in some cases when all ciliary power has been suspended by atropia or homatropia, is strong proof that sectional ciliary action does not cause it. I am not convinced that sectional ciliary action ever occurs, but I am sure that it never causes "binocular astigmatism."

Let us study, in reference to Martin's theory, a case of simple hypermetropic astignatism, with the emmetropic meridian in right eye at 75°, and that of left eye at 105°. Under suspension of accommodation we find the glasses needed to be +3 cyl. ax., for right eye at 75°, and for left at 105°. If Martin's theory be true, such eyes, when uninfluenced by medicine, have the power of partly correcting their faulty, without changing the refraction of their correct, meridians. To do this that part of the ciliary muscle behind the meridian at 75° in right eye, must not act while every other part must be thrown into action, the maximum of power being exerted by that part behind the meridian at 165°. The same may be said of the left eye substituting 105° for 75° and 15° for

165°. Does this kind of action occur in such eyes? I have never seen the evidence. If it were to occur while the correcting lenses are being worn, distant vision would be more blurred than near vision, but rectangles would have their natural appearance and the floor would not slant. The only thing to be done in such a case would be to give a weaker pair of cylinders (a practice based on Martin's theory) allowing the axes to remain as before.

Again taking the same pair of eyes we may suppose that the ciliary strain at the points corresponding to 90° is just enough to make those meridians emmetropic without affecting the originally emmetropic meridians. Then rotate the cylinders, the one for the right eye from 75° to 90°, and the one for the left eye from 105° to 90° so that they may correspond with the (supposed) newly made emmetropic meridians; and you will find that the part of the cylinder corresponding to 75° in one eye and 105° in the other, has a converging power of .50 dioptres, necessarily focusing in front of the retinæ the rays passing through those meridians. Such a condition would distort and dim objects near and far, whether the positions of the axes of the cylinders remain at 90° or be placed back at 75° and 105°.

Or again we can suppose that the ciliary strain, while making the vertical meridians emmetropic, so acts on the formerly (naturally) emmetropic meridians as to make them myopic—it could not make them hypermetropic. The lenses placed as before would only distort and dim objects still more, which no moving of cylinders could improve.

To me it is clear that ciliary strain, sectional or general, does not cause the phenomena giving rise to the name "binocular astigmatism." That ciliary strain can aggravate the acting cause of "binocular astigmatism" is true.

3. The cause of "binocular astigmatism" is the *harmonious non-symmetrical action of the oblique muscles*, which function was discovered by myself and explained in the paper read in Chicago, already referred to. By the expression "harmonious non-symmetrical action of the oblique muscles" I mean that

the superior oblique of one eye acts with the inferior oblique of the other in such a way as to rotate the eye-bails so as to alway keep the naturally vertical meridians parallel, thus preventing double vision. For instance, the right *superior* oblique by contracting may roll its eye-ball so that the naturally vertical meridian, instead of being allowed to stand at 90°, is made to stand at 75°, and at the same moment the left *inferior* oblique will roll its eye so that its naturally vertical meridian is made to stand at 75°, the two being still parallel though leaning. This peculiar function is exercised in most if not in all cases of astigmatism, before correction by means of lenses, when the best meridian of one or both eyes is somewhere between the vertical and horizontal meridians; and the object of the action is to make the emmetropic meridian approach the vertical, if nearest it, or the horizontal, if nearest it, so as to make vision sharper.

Take a case of simple hypermetropic astigmatism with the best meridian in each eye at 105°, no glass ever having been worn. To sharpen vision the superior oblique of the right and the inferior oblique of the left will revolve their respective eyes so that the emmetropic meridian of each eye will be brought to the vertical, having described an arc of 15°. While doing near work these muscles will hold the emmetropic meridians in their new positions until forced by fatigue to resume a state of rest. This habit of rotation is formed early, and continues throughout the life of the individual, unless a pair of correcting lenses are given. At first, even with the glasses on, the old habit of rotation may continue, and if so, some of the phenomena of "binocular astigmatism" will appear. The rectangle will be but little changed, but the floor will slant from left to right, which phenomenon will continue until the eyes learn that vision is now sharper and easier without than with rotation, at which time the harmonious non-symmetrical action of the oblique muscles will cease.

Again take a case of simple hypermetropic astigmatism, the emmetropic meridian being at 75° in right eye and at 105° in left eye. The inferior oblique of the right eye can place its

emmetropic meridian at 90°, but at the same moment the superior oblique of the left eye will move its emmetropic meridian from 105° to 120°, the vision being sharpened in the right eye by the rotation, but more blurred in the left eye. During this state of things the mind takes cognizance of the image in the right eye only. Let these muscles become fatigued, and, in a moment the work is shifted from them to the superior oblique of the right eye and the inferior oblique of the left eye, thus placing the best meridian of the right eye at 60° and that of the left at 90°, the sharper image, the one the mind considers, being this time in the left eye. This shifting of labor may occur once or many times during the long continuance of near work. Now a proper cylinder having been given each eye, the axis of one at 75° and that of the other at 105°, the old habit of rotation may continue for a time; if so there will appear some of the phenomena of "binocular astigmatism." With the glasses on, if the eyes are revolved by the inferior oblique of the right and superior oblique of the left eye, the right end of the rectangle will be narrowed, its left border will incline from left to right, and its lower border will slope up from left to right and the floor will slant from right to left. Let the labor be shifted to the superior oblique of the right eye and the inferior oblique of the left, than the left end of the rectangle will be narrowed, the right border will incline from right to left, the lower border will slope up from right to left, and the floor will incline from left to right. In both cases the upper border will be shortened.

Examples could be multiplied, if necessary, for the establishment of the fact that there is a harmonious non-symmetrical action of the oblique muscles which is exercised in many if not in all cases of astigmatism when the best meridians happen not to be vertical or horizontal; and that the rotation of the eye-balls resulting from this action, if continued from habit after the proper glasses have been given, causes the phenomena of "binocular astigmatism."

Every ophthalmic surgeon may produce in his own person

all the phenomena of "binocular astigmatism." His own eyes must be emmetropic naturally or by means of proper glasses; then let him by means of convex cylinders in the back division of his trial frames produce myopic astigmatism in his own eyes, and then with concave cylinders of same power in front division of trial frames, correct his artificial myopic astigmatism. So long as the axes of these cylinders coincide vision proximal (provided there is no presbyopia) and remote will be perfect, the rectangle will be a rectangle still, and the floor will not incline; disturb this relationship and you dim vision, distort the rectangle and incline the floor. To be specific: let the experimenter put a+3 cylinder for each eye in back part of his trial frames with axis of right at 20° and that of left at 160°. He thus produces simple myopic astigmatism in each eye, the emmetropic meridian in his right being at 20° and that of his left at 160°. It is clear that glasses ground after the following formulæ will fully correct this defect; for O. D.—3 cyl. ax. 20°.

" O. S.—3 " " 160°.

Disturb this relationship between the axes of these cylinders and the emmetropic meridians (axes of convex glasses) of the artificially myopic astigmatic eyes, as the relationship would be disturbed by the contraction of the superior oblique of one eye and the inferior oblique of the other, if the astigmatism was not artificial, then the rectangle loses its shape, and the floor slants. Suppose the convex cylinders (those producing the defect) inseparably connected with the eyes, moving with their every motion, hence, subject to the action of the oblique muscles, then the right superior oblique rolling its eye carries the axis of its cylinder from 20° to 180°, and the left inferior oblique likewise carries the axis of its cylinder from 160° to 140°, the axes of the correcting (concave) cylinders still remaining at 20° and 160°. This change would narrow the right end of the rectangle, and slope downward its upper border from left to right, and would make the floor appear to slant from left to right. Or if the inferior oblique of right and superior oblique of left act in like manner, then the

emmetropic meridian of right eye would be at 40° and that of left eye at 180°, the correcting (concave) glasses still having their axes at 20° and 160°. This would narrow the left end of the rectangle, make its upper border slope down from right to left and would cause the floor to slant from right to left.

Again we may produce with the same + 3 cylinders simple myopic astigmatism letting the emmetropic meridians be at 20° in each eye. The correcting glasses would be the — 3 cyl. ax. 20°. Still supposing that the + 3 cylinders are movable with the eye-balls, then the right superior oblique rolling its eye would carry the axis of its cylinder from 20° to 180°, and the left inferior oblique would, in like manner, change the axis of its cylinder from 20° to 180°, the axes of the correcting cylinders still remaining at 20°. This disturbed relationship would develop the following phenomena: rectangle not much altered but possibly a little narrower at left end and upper border on account of changed direction (slight) of right and lower borders; floor slants from left to right.

With the same + 3 cylinders, produce simple myopic astigmatism so that the perfect meridian of right eye shall be at 20° and that of left at 110°. The correcting lenses would be the — 3 cylinders with their axes at 20° and 110° respectively. Still supposing the + cylinders to move with every movement of the eyes, then the right superior oblique, in revolving its eye, would move the axis of its cylinder from 20° to 180°, and the left inferior oblique, in like manner, would move the axis of its cylinder from 110° to 90°, leaving the axes of the correcting lenses at 20° and 160° respectively. With this displacement, by revolution, of the perfect meridians, are developed the following phenomena: the right and left borders of the rectangle lean towards each other at the top thus shortening the upper border, lower border possibly a little curved, the convexity looking up, and the floor a little curved in same way.

These experiments can be multiplied indefinitely, each time

some of the many interesting phenomena of "binocular astigmatism" showing themselves.

Experiments as to simple hypermetropic astigmatism may be performed by making the — 3 cylinders take the place of the + 3 cylinders and vice versa, in the experiments just noted. I had intended giving the details of fourteen experiments, but my paper is growing too long.

It is interesting to notice that, in those experiments in which a disturbance of the true relationship of the axes of the correcting lenses and the axes of the astigmatic-producing lenses (the emmetropic meridians) brings about a narrowed condition of the right end of a rectangle and a slanting condition of the floor from left to right, by making the axes af the right lenses only coincide again, the floor is made almost level but the right end of rectangle remains narrowed; while, by making the axes of the left lenses only coincide, the floor is leveled and the ends of the rectangle appear equally wide. This corresponds with what Dr. Culberton observed on moving only one lens in his recorded cases (the first part of my observation above noted he did not record). If the left end of the rectangle is the narrowed one, and the floor slants from right to left, then the moving of the right cylinder in the proper direction corrects these appearances. But by moving the right cylinder only when the left end of the rectangle is narrowed, or the left cylinder only when the right end of rectangle is narrowed, in order to make both ends equally wide, we do not obtain a perfectly formed rectangle. If Dr. Culbertson had pressed his inquiries his patients would have said: "While the ends of the rectangle are now of equal width, the upper margin is shortened by the right and left margins leaning slightly towards each other at the top." To have corrected the rectangle perfectly he should have moved both cylinders in the same direction and through the same are, so as to make the axes of the correcting lenses and the rotated emmetropic meridians coincide.

If what I have taught in this paper is correct—that it is correct any ophthalmic surgeon may soon convince himself by

thought and experiment—Dr. Culbertson's practice of changing the axis of one cylinder for the correction of "binocular astigmatism" is erroneous, as would be the practice of changing the axes of both cylinders. Such glasses would be better than none, but the eyes would have to continue to rotate, however with better effect, for the rotation now gives perfect vision, whereas before the glasses were given there was only an approach to perfection of vision. For example, by monocular tests it is found that the natural location of the emmetropic meridian of the right eye is at 20° and that of the left is at 160°; and the correcting lenses are placed in the trial frames accordingly. In binocular vision, if the old habit of rotation is kept up, the left superior oblique may at once roll its eye so that its best meridian stands at 180°; and at the same moment the right inferior oblique, acting in harmony with the left superior oblique, must roll its eye so that its best meridian is moved from 20° to 40°. In this state of things the left end of the rectangle is narrowed and the floor slants from right to left. On turning the right correcting cylinder from 20° to 40° so that it may coincide with the emmetropic meridian in its new position, the floor is made level and the two ends of the rectangle appear of equal width (as said before the upper margin of rectangle is shortened,) effects, as to rectangle, that cannot be gained by changing the position of left cylinder only, from 160° to 180°, so that it might coincide with the best meridian of the left eye in its new position. Then with the axis of left cylinder at 160°, as determined in the monocular test, and with axis of right cylinder changed from 20° (point determined in the monocular test) to 40° (point to which the emmetropic meridian has been rotated), while the superior oblique of the left and the inferior oblique of the right eye continue their harmonious non-symmetrical action, there is absolutely perfect vision in the right eye but blurred vision in the left. Let this pair of muscles become fatigued, then they relax their straining power and the eyes roll back into the position of rest (naturally vertical meridians vertical), so that the emmetropic meridian of the left eye comes again to its natural

position (160°,) exactly coinciding with the axis of its correcting cylinder; and the emmetropic meridian of the right moves from 40°, the point to which the axis of its cylinder had been changed, back to 20°, its natural position. During the continuance of this rest there is perfect vision, proximal and remote in the left eye, but blurred vision in the right. But in this state of rest of the oblique muscles, the floor is made to slant from left to right and the right end of the rectangle is narrowed, due to the changed position of axis of right cylinder, so that vision is not so comfortable; and in a short time the originally acting muscles resume their work. This process must be repeated so long as such glasses are woru. Without the glasses the rotation must be through a greater arc, but the one pr. of obliques "spells" the other; with the glasses all the rotation is accomplished with one pair but the arc of rotation is greatly lessened, therefore these glasses may be more comfortable than none.

In the example just given, if the axes of both cylinders had been changed so that the axis of the left would have been at 180° while that of the right cylinder stood at 40°, the points to which the emmetropic meridians had rotated, there would then have been perfect vision in both eyes, the floor being level and the rectangle perfect (not narrowed at the top as it was when only the axis of the right cylinder was changed). With the two axes thus changed the price of perfect sight is tonic contraction of the superior oblique of the left eye and the inferior oblique of the right; but the degree of contraction being less—a smaller arc to be described then when, without glasses, one pair of obliques would shift the labor to the other—than that to which they had been accustomed, they may bear this strain with some degree of comfort.

The correct practice in all cases of astigmatism is to give the fully correcting lens, and to place its axis so that it will coincide with the best meridian in its natural position, which can always be found in careful monocular examinations with accommodation suspended. There will be no tendency to rotate, the habit of rotation never having been formd, if the axes

of the cylinders are needed at 90° or 180°. In some cases, the emmetropic meridians not being vertical or horizontal, the habit of rotation is broken at once on commencing the use of glasses, and no "binocular astigmatism" is noticed; but in other cases the habit of rotation continues from a few hours to a few days, "binocular astigmatism" necessarily resulting. The disposition to rotate is aggravated by accommodation, hence in rebellious cases either direct the patient to voluntarily abstain from "near work," or else suspend his accommodation with atropia for a few days. In all cases the phenomena of "binocular astigmatism" will pass away in a longer or shorter time, if the axes of the cylinders have been properly placed; for the eyes will learn that there is now no longer any need for rotation—that rotation now makes vision worse and not better. To determine the position of the axis of the cylinder is the most difficult part of tne work of refraction, and always requires patience and time. I devote from two to three consecutive hours to every case of astigmatism, and examine each eye separately, and in all persons under 50 years of age I fully suspend the accommodation by means of homatropia.

THE REMOVAL OF CHALAZIA AFTER THE METHOD OF DR. AGNEW.

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The operation in vogue for the removal of chalazia is by incision upon the conjunctival or skin surface of the lid. This is the method described in all text-books at my command. Authors differ somewhat upon the liability of these growths to recurrence and upon the question of their anatomical structure. For instance, Mackenzie, (1855), says they are uncysted; Nettleship, (1883), maintains that there is no cyst wall; Swanzy, (1884), asserts that the sac of the tumor consists of the walls of the gland. This is also the opinon of Soelberg Wells, Juler, Noyes, Stellwag and Carter.

Fuchs describes the mechanism of their formation as follows: "A disturbance in the nutrition of the Meibomian gland excites a chronic inflammation of the connective tissue around the gland, which leads to an infiltration of the latter with small cells. By a coalescence of several groups of cells there results a nodule which consists of granulation tissue with giant cells. Swanzy states that they are liable to return, especially when not thoroughly evacuated. Nettleship asserts that they never recur. It is the experience of every one at times to see a recurrence, unless the growth be enucleated entire through the skin surface. Under such a method of removal the sac of the growth which is the dilated gland wall is gotten rid of, and thus the Meibomian secretion is checked.

All authorities advise removal of the ordinary form of chalazia through the conjunctival incision. This incision is gener-

ally an enlargement of an existing sinus which leads into the tumor, but which is too small to permit the escape of the jelly like contents. This incision into the conjunctiva leaves a linear scar, which, if situated close to either extremity of the lid or far back toward the retro-tarsal fold, gives rise to no trouble, but if it be close to the free edge and near the center of the ciliary margin, it may by friction upon the cornea give rise to annoying and unremedial irritation, or changes in the corneal epithelium. The only reference I find to the method employed by the late Dr. Agnew, is an interpolation by the editor of the last American edition of Soelberg-Wells' text-book, page 90. Dr. Bull says: "It is better in all cases where the tumor is not too large or too far removed from the ciliary margin, to open the lid with a narrow knife along the ciliary margin, carrying the point of the knife well into the tumor. Then the contents can be squeezed out between the thumb and finger or a small spoon can be introduced through the wound and the contents evacuated. This avoids leaving a scar on the external or internal surface of the lid." It has been the custom at the Manhattan Eye and Ear Hospital in the service of Dr. Agnew to remove chalazia of the upper lid by an incision along the ciliary margin. The operation is there credited as original with Dr. Agnew. His method is as follows: Grasp the lid firmly between the thumb and index finger and slightly evert the edge, with a Graefe or Beer's knife an incision is made well into the growth; the contents are squeezed out or a strabismus hook or Daviel spoon is introduced and the jelly-like material thoroughly scooped out. The cavity rapidly fills with blood, but under frequent applications of hot water in a few days the blood is absorbed and the swelling subsides, leaving no vestige of its original presence and no scar to mark the site of its removal. Dr. Agnew claimed that when the enlargement was in the lower lid the p.ocedure did not answer so well as the incision through the conjunctiva, and that there was not the same objections to a scar in this locality as pertained to the upper lid. For the past three years it has been my routine practice in all cases to remove these tumors

after this method. In private and hospital practice I have removed about thirty and in one case only has there been a recurrence coming under my notice.

My way of operating differs from the original in the following particulars. The lid corresponding to the seat of the growth is firmly grasped between the thumb and forefinger, and by pressure a drop of the jelly-like contents will be forced to present itself from the mouth of one or more of the Meibomian ducts. Thus finding the opening of the obstructed gland the needle of a hypodermic syringe charged with a few drops of a 4 % solution of cocaine is forced into the mouth of the duct and passed into the substance of the tumor and a few drops left in it and also in the track of the needle in withdrawing. Cocaine is also instilled into the eye to allay the irritation from the finger in contact with the globe. In three minutes again grasping the tumor between the fingers an incision is made along the lid margin with a Graefe knife following the course taken by the hypodermic needle; an incision twice the width of the knife blade is made well into the substance of the cyst, a small sharp-edged curette is introduced and the contents thoroughly broken up and removed. With a lachrymal syringe the cavity thus left is thorougly irrigated with a solution of the bichloride (1-2000). After this procedure the cavity slightly fills but never to its original capacity with blood. A hot bichloride solution as a wash for a few days removes every trace of the original protrusion. When the growth is in the lower lid the same procedure is instituted, and when making the incision I carry the knife through the tumor making a small counter opening below on the conjunctival surface. By this opening the bichloride solution passes through, and the cavity is thus left in the best condition for drainage. In two instances I have removed these unsightly growths from timid subjects without pain,after they had refused the more formidable operation by incision through the conjunctiva at the hands of other surgeons. In the treatment of styes the same procedure may be successfully applied, the use of the curette only being dispensed with.

A CASE OF INSUFFICIENCY OF THE INTERNI WITH PROGRESSIVE MYOPIA IN WHICH DR. C. R. AGNEW PERFORMED A TENOTOMY OF AN EXTERNUS.

BY DAVID WEBSTER, M. D., NEW YORK.

Frank S., eighteen years of age, consulted Dr. C. R. Agnew and myself on May 14, 1877, on account of a severe and persistent asthenopia. He was "a blonde with rather soft flesh," and had been studying nine or ten hours a day.

Without glasses his vision was $^{16}/_{C}$ each eye; with $-^{1}/_{13}$ the vision of each eye was $^{20}/_{XX}$. Examination with the ophthalmoscope revealed no staphyloma posticum. A solution of sulphate of atropia, four grains to the ounce, was ordered to be dropped into both eyes thrice daily, and medium smoked coquilles were ordered to protect his eyes from the light.

May 21. The accommodation being entirely done away with by the mydriatic, the vision and refraction were found the same as before, namely, $^{20}/_{XX}$ with $-^{1}/_{13}$ each eye.

June 5. The eyes having recovered their power of accommodation it was found that the patient could see $^{20}/_{XX}$ with $-^{1}/_{14}$ over both eyes at once. Glasses $-^{1}/_{14}$ were ordered for distant vision, and the patient was directed to do his reading with or without them, as he should find most comfortable.

Mr. S. did not appear again until October 30, 1878, when his eyes having again partially given out from overwork and evening use, Dr. Agnew advised him to abandon all use of his eyes for study at night, and to spend his evenings exercising in the gymnasium.

Dec. 5, 1879. Mr. S. is now wearing glasses $-^{1}/_{11}$ with which he has very imperfect distant vision.

The vision of each of his eyes is $^{20}/_{XX}$ with $-^{1}/_{8}$, the myopia of both eyes having increased in about two and a half years from $^{1}/_{13}$ to $^{1}/_{8}$. Still, there is no staphyloma posticum in the right eye, and only a narrow crescent in the left.

April 56, 1882. Mr. S. states that he went to London in 1880, and consulted Dr. Liebreich, who gave him $-^{1}/_{20}$ s. ⌒ prism $3^{1}/_{2}°$ for both eyes. He improved very much while knocking about, and got to reading four or five hours a day. He came back to New Jersey and returned to college, but his eyes soon began to trouble him again. He consulted Dr. Knapp, who said he had conjunctivitis, and gave him washes of alum, zinc, etc.

He went to London again in the summer of 1881 and again consulted Dr. Liebreich. The latter gave him various washes for his conjunctivitis and prisms, $5^{1}/_{2}°$ base toward the nose, for both eyes.

Mr. S. now complains of a feeling of irritation in his lids, causing him to "blink." He cannot read much without pain, but his eyes vary very much. He has insufficiency of his interni 16° at 20′, and 18° at 1′. He has lately consulted Dr. Knapp again who suggests tenotomy of an externus.

May 2, 1882. Dr. Agnew performed a tenotomy of the right external rectus, through a horizontal wound in the conjunctiva, the patient being under ether. The conjunctival wound was closed by a stitch.

May 10. Mr. S. says his eyes have not felt so well for a year and a half as they have since the operation, notwithstanding a homonymous diplopia which he has experienced since the tenotomy. The images are about three feet apart at a distance of twenty feet.

May 16. Insufficiency of externi 13° at 20′.

May 19. The patient can see singly for a few moments without prisms at twenty feet.

May 25. Mr. S. has recovered binocular single vision for all distances.

The vision of each eye is $^{20}/_{XX}$ with $-^{1}/_{7}$.

May 31. Ordered $-^1/_{16}$ for constant and $-^1/_7$ for occasional use.

Aug. 14, 1883. Mr. S. reports that his eyes are much better than before the operation. He says there was a steady improvement for six or seven months, and that the symptoms for which the tenotomy was performed seem to be permanently relieved.

A PECULIAR DERMOID TUMOR OF THE CONJUNCTIVA.

BY H. V. WUERDEMANN, M. D.
Assistant Surgeon, Washington Eye and Ear Infirmary, Washington, D. C.

Dermoid tumors of the conjunctiva are not very rare, and are usually situated at the limbus, appearing partly on the cornea and partly on the sclerotic. One or two short hairs may protrude. The case below is unusual in the situation of the growth and in the character of its hirsute appendages.

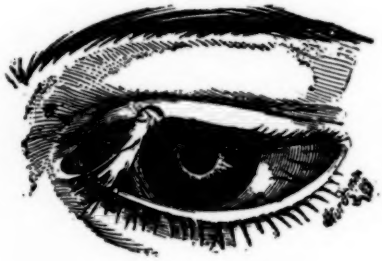

FIG. 8.

July 18, 1888, W. S. H., white, male, æt. 59, messenger in U. S. service, consulted me for conjunctivitis which was relieved. At first sight there seemed to be a yellowish white feather growing from the edge of the upper lid, taking the same direction as the cilia. Upon examination the excrescence

was recognized as a small dermoid tumor of the conjunctiva, about the size of a grain of wheat. On everting the lid, the growth was seen to extend back 4 mm. from the edge of the lid. It also projected externally for 2 mm. The hirsute growth was $^3/_4$ of an inch (nearly 2 cm.) in length. It was very fine and appeared of a woody nature.

The patient refused to have the tumor excised, as he was proud of the appendage and believed it to be a feather.

He informed me that the hair grew at least one inch (25.cm.) in six weeks after being pulled out; the tumor had existed for ten years.

By microscopic examination the hair from the tumor appeared similar to fœtal wool. It was probably a product of retrograde metamorphosis with subdivision of one or two cilia. The illustration, Fig. 9, shows a portion of the outgrowth with one of the cilia.

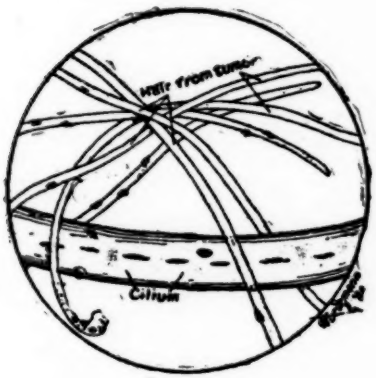

FIG. 9.

ABSTRACT OF THE PROCEEDINGS OF THE SEVENTH INTERNATIONAL CONGRESS OF OPHTHALMOLOGY HELD AT HEIDELBERG, AUGUST 8 TO 11 1888.

REPORTED BY DR. L. HOWE, BUFFALO, N. Y.

The first session Wednesday morning was called to order by Prof. Donders of Utrecht, in the name of the committee on organization. He welcomed the members cordially, who, to the number of more than two hundred had assembled from every country of Europe, from the United States, South America, Australia, Egypt, and Japan.

Incidentally he referred to Helmholtz, who was present, and at the name of one who had done so much for ophthalmology, the members arose and applauded in testimony of their respect and esteem.

After further welcomes by Becker in the name of the Government of Baden, Arnold, for the University of Heidelberg, Herr Wilkens, the mayor, for the city, the following officers of the permanent organization were elected:

President, Donders, of Utrecht; Vice-President, Zehender, of Rostock; General Secretaries, Stilling, of Strassburg, and Hess, of Mayence; Recording Secretaries, Valude, of Paris, Brettauer, of Triest, and Swanzy, of Dublin.

JAVAL (Paris), made the first communication, giving the history of the improvements in the ophthalmometer, and described certain elaboration of details introduced since his last publication. Still he does not yet consider the difficulties are all overcome.

DUFOUR (Lausanne), enquired as to the practical utility of the instrument in the present form.

JAVAL said, that occasional cases undoubtedly existed in which the astigmatism of the lens was so great as seriously to complicate the results of corneal measurement. Two such examples were detailed. With certain corrections, however, the figures obtained could usually be relied upon,although in young subjects a considerable apparent astigmatism of the cornea is often neutralized practically by compensating unequal changes in the lens.

Further observations on the subject were made by Pflueger, of Berne. Sattler, of Prague, Schoen, of Leipzig, and Schneller, of Danzig.

GRAEFE (Halle).—"On the action of the internal recti in associated lateral movements, and in those of accommodation and convergence." He described a case in which the ability to converge on both sides persisted while other associated movements of the internal recti were lost. Two similar cases from the literature were cited, and he concluded, that there were two distinct centres in the brain, presiding respectively over accommodation and convergence.

REYMOND (Turin).—Adjunct reporter on the same subject. Dwelt at length upon this same relation between convergence and accommodation, and expressed the opinion that when binocular vision was not possible, the deviating eye tended rather to diverge, that being its most natural position.

LANDOLT (Paris), concurred in the opinion of Graefe, citing cases of hysterical contractions of the internal recti.

LANDOLT (Paris).—"On the cause of Strabismus." Strabismus exists whenever the two eyes are not simultaneously directed at a fixed point. The eyes are indeed held in position by the act of binocular vision. Therefore, the absence of binocular vision and of accommodation predisposes to strabismus. Among the principal causes of strabismus there should be mentioned first the connection between convergence and accommodation.

LANDOLT (Paris).—"Treatment of Strabismus." After a thorough examination of the vision, accommodative power, degree of strabismus, field of fixation, etc., one can form an idea as to

the advantage to be gained from stereoscopic exercises, mydriatics and convex glasses. These are of advantage only in recent or moderately advanced cases. Complete tenotomy, especially when combined with sutures, is advisable only where the deviation is great, but a moderate tenotomy can decidedly assist the action of the antagonistic muscle. Whenever the strabismus is due to any loss of power of a muscle, as is frequently the case, advancement of that should be combined with tenotomy of the opponent.

DEWECKER (Paris), insisted upon the importance of the tendinous fibres given off by the muscle, and considered that the success or failure of the operation depended upon the properly altered position of Tenon's capsule.

SCHWEIGGER (Berlin), said he usually preferred the advancement to tenotomy for the reason that it was then easier to graduate the degree of correction.

KNAPP (New York), referred to statistics he had already published relating to this subject, and said that in a large number of cases he employed deWecker's method of capsular advancement. It was modified, however, as necessary by the sutures in the muscle, capsule or even the episcleral tissue, and by removing them gradually as appeared advisable.

After further discussion the subject was closed by the reply of Landolt to the various criticisms offered.

STILLING (Strassburg).—"On the relation between the formation of the skull and the formation of the eye." Gave a résumé of the results of measurements, already published, tending to show that a low, broad orbit accompanied myopia, and a narrow high one accompanied hypermetropia.

SCHMIDT-RIMPLER (Marburg), reported the measurements made in seventy-five cases in which no such relation existed and

COHN (Breslau), concurred in the same opinion adverse to the theory, while

WEISS (Mannheim), had observed several times the concordance between the two.

Morning Session August 9.

Gayet (Lyons), "On the operation of cataract," gave a résumé of his opinions in the form of nineteen distinct propositions. The statements which apparently called for criticism were:

No. 8. That the iridectomy is unnecessary and rarely useful.

No. 9. The opening of the capsule should be made at the same time as the corneal incision and with the knife.

No. 12. The anterior chamber can be washed out with sterilized water or an antiseptic if desired.

No. 15. Neither atropine nor eserine are absolutely indicated or contra-indicated.

No. 19. Secondary operations are uncertain and dangerous.

Schweigger (Berlin), referred to the imperfections of statistics based on insufficient data. The use of cocaine, improvements in operative methods and antiseptics enable us now to return more toward flap incision and also to avoid the iridectomy. Upon the latter point he dwelt at considerable length, giving statistics to fortify the position taken.

Discussion.

DeWecker (Paris), thought the Graefe knife should be retained in preference to all others. Also thought eserine was advantageous and so harmless as to be with safety injected into the anterior chamber.

Wicherkiewicz (Posen), said he never used atropine before operation, and to that fact he attributed this small proportion of cases where prolapse occurred.

Critchett (London), advised the use of the fingers instead of a blepherostat. As to the iridectomy, he considered the advantage of safety, thus gained, so much greater than all else without it, as to leave to him no question of choice. At least he thought any oculist who might be unfortunate enough to have cataract himself, would prefer in its removal, the method with the iridectomy.

GALEZOWSKI (Paris), said he made the puncture and counter-puncture from 2 to $2^1/_2$ millimetres in the sclero-corneal margin. Also that he kept the eye closed, if all went well for six days after the operation.

LAQUEUR (Strassburg), called attention to the overuse of cocaine as denuding the cornea of the epithelium in spots, and rendering the eye liable to complicating processes.

HAASE (Hamburg), asked of Schweigger how long he kept the eye closed after operation.

SCHWEIGGER.—Ordinarily till the third day.

HIEMEL (Leipzig), descrides a procedure by which he made a circular opening with a needle in the centre of the capsule, after that the flap incision is made and the lens is then ready to escape.

CHIBRET (Clermont-Ferrand) showed the disadvantage of an excess of cocaine as illustrated by the mistake of a druggist. As for iridectomy, he avoided that, excepting snipping off whatever part protruded after the incision.

GRAEFE (Halle), could not allow the attacks on atropine to pass without a protest. He used it invariably, and never had observed any injurious results.

KNAPP, after giving his more recent statistics, said in those cases he used a small knife, made the incision very near the periphery, and then omitted the iridectomy. As soon as the lens was expelled he washed out the anterior chamber with a sublimate solution 1 to 10,000. If the vision did not come up to $^2/_5$ or $^2/_3$, a secondary operation on the capsule was made.

MEYER (Paris) called attention to the dangers of the iris remaining in the wound, as is frequent when iridectomy is omitted, and cited the opinion of von Graefe on the point.

DE WECKER objected that Becker had discovered pieces of iris caught in the wound on nearly all the eyes he had made sections of, even after the iridectomy for extraction had been performed.

KNAPP, in closing the discussion, said, that so important a question could not be decided then, but he thought the princi-

pal advocates for iridectomy were among those least acquainted with the method of extraction without it.

AFTERNOON SESSION.—AUGUST 9.

JESSOP (London), "On the physiological action of the intra-ocular muscles." Related a long series of experiments which led to the conclusion that irritation of the short ciliary nerves produces contraction of the iris (myosis) and irritation of the long ciliary nerves produce the contrary effect.

COCCIUS (Leipzig), "On the tensor action of the choroid." Described the appearance presented by the posterior capsule during accommodation. This showed an almost vibratory motion of the lens which was particularly noticeable in cases where the vitreous was partly fluid.

DE WECKER, "On the treatment of persistent lachrymation." Pointed out the difference in location and possible function between the orbital and palpebral lachrymal glands. It was the latter which he had been accustomed to remove by forcibly everting the upper lid, dissecting up the conjunctiva, drawing the gland foaward with forceps and removing it. Little or no after-treatment was necessary and in a series of 25 cases, the results were exceedingly satisfactory.

DISCUSSION.

GRUENING (New York), cited a case to show, how persistent lachyrymation could depend entirely upon some slight obstruction in the nose, and thought the nares should always be brought into a healthy condition before any operative procedure was resorted to.

EVERSBUSCH (Erlangen), had recently removed the orbital lachrymal gland for the same purpose, not from the conjunctival surface, but through an incision in the fronto palpebral fold.

COHN (Breslau), "On intra-ocular photography." Attention was first called to a simplified form of the magnesium light, and several photographs shown of the lids, cornea and iris

taken by means of it. He considered the difficulties in illuminating the interior of the human eye, and viewing it at the same time, almost insurmountable, but presented two photographs of the fundus of the artificial eye of Perrin which after several trials he had obtained.

Discussion.

Howe (Buffalo), proved that greater part of these difficulties had been overcome by presenting a photograph which showed the details of the fundus. The method of rendering the plate sensitive to the reflection and also the apparatus used had been described by himself and Dr. Starr a year previous, and he hoped, in the future, photographs might be obtained perfectly well defined and free from the corneal reflex which thus far persisted as a white patch.

Knapp, described a method of instantaneous illumination which he thought should facilitate the precedure.

Galezowski (Paris), detailed the attempts he had made in the same direction, but thus far he had been unable to obtain any recognizable picture of the fundus.

Javal (Paris), pointed out, how the instantaneous photography would be used in ophthalmometry, giving results which could be measured to millimetres.

Chibret asked if the difficulties of the corneal reflex would not be obviated by means of a Nichols prism, and,

Parent (Paris), replied that he also had attempted intraocular photography, and had not succeeded in obtaining any satisfactory results.

Crainicean (Bucharest) gave "statistics relating to an examination of 8000 children" which corresponded in general with similar figures already published.

Discussion.

Priestly-Smith (Birmingham), said that in spite of our statistics, and what they prove, it is lamentable that so little

notice is taken of them in England and elsewhere by those who have charge of the pupils.

DUERR (Hanover), "On megalophthalmia." He had dissected several such eyes, finding the superior oblique more oblique than it should be, and pressed tightly onto, or even into the sclerotic.

MORNING SESSION—AUGUST 10.

GLAUCOMA.

DR. PRIESTLEY SMITH formulated our knowledge of the subject in nine clearly defined propositions, which were already too well condensed to admit of abridgment without mutilation.

DEFINITION OF GLAUCOMA.—An excess of pressure within the eye, plus the causes and the consequences of that excess. Pressure is an essential factor. A glaucoma without increased tension is probably a glaucoma examined during the intermissions of increased tension.

The pressure of the intraocular fluids is determined by 3 conditions:

a. The condition of the secreting organs,

b. The condition of the outlets,

c. The condition of the fluids themselves.

The aqueous and vitreous fluids are secreted by the ciliary portion of the uveal tract. The aqueous escapes at the angle of the anterior chamber (filtration angle.) The vitreous fluid escapes at the papilla, very slowly as compared with the aqueous. Any surplus fluid in the vitreous can pass easily, in the healthy eye, into the aqueous chamber. The condition of the papilla cannot have much influence on the intraocular pressure. An albuminous fluid escapes from the anterior chamber much less rapidly than a normal salt-solution under the same pressure.

The chief factors which can raise the intraocular pressure are therefore: *a.* hypersecretion by the cilliary processes; *b.* obstruction of the filtration angle; *c.* serosity of the fluids.

Hypersecretion is sometimes the exciting cause of the attack, but the glaucoma-process cannot be explained by the hypothesis of a persistent hypersecretion.

Obstruction at the filtration angle is present in most cases of glaucoma; the angle is compressed or closed. Experiment proves that, when the iris-base is pushed forwards, filtration is greatly retarded. It is true that the filtration angle is sometimes closed in eyes which have no glaucoma, but in such eyes there are other changes which render glaucoma an impossibility; the fluid escapes by abnormal outlets, or it is no longer secreted.

Serosity of the fluids is present in many forms of glaucoma. It is a very important factor in the secondary glaucoma of serous iritis and kerato-iritis; in these cases the filtration angle is widely open and the chamber deep.

In most forms of glaucoma the filtration angle is closed. What are the antecedent changes? When they are invisible, we call the glaucoma "primary"; when they are visible, we call it "secondary."

In certain forms of secondary glaucoma we can see the manner in which the filtration angle is closed. Examples: 1. The lens is injured; it swells and pushes the iris against the cornea. 2. The lens falls into the anterior chamber, and occludes the pupil from in front; the aqueous, imprisoned behind the iris drives it forward against the cornea around the margin of the lens. 3. The entire pupil-margin adheres to the lens; the fluid imprisoned in the posterior aqueous chamber pushes the iris against the cornea. In every form of secondary glaucoma, except those in which the aqueous chamber is distended by serous fluid, the iris-base is found on dissection to be pushed forwards against the cornea.

In primary glaucoma of recent date dissection shows the iris-base pushed forwards by the swollen ciliary processes and in many cases the processes are themselves pushed forward by the lens and zonula.

The chief predisposing cause is an insufficient circumlental

space. Thus the liability to glaucoma increases with age, because the lens grows larger as life advances. Again, the liability is greater in the hyperopic eye, because the ciliary muscle and processes are more prominent in the direction of the lens. Again, a small cornea appears to predispose to primary glaucoma: in 227 persons measured with a special keratometer the average horizontal diameter of the cornea was 11.52 mm; in 52 persons suffering from primary glaucoma in one or both eyes it was 11.02 mm. A cornea measuring 10.5 mm. or less is exceptional; among the unaffected persons it was found in about 4 per cent, among the affected persons in 31 per cent. It is at present uncertain whether the small cornea of such eyes is a congenital peculiarity or a senile change. (The investigation is not yet completed.)

Senile changes in the vitreous which obstruct filtration into the aqueous chamber are perhaps among the predisposing causes, Perhaps also, in minor degree, senile rigidity of the sclera and senile degeneration of the blood vessels.

The chief exciting causes are those conditions which overfill the uveal tract with blood. General disturbances which depress the circulation and overfill the venous system are the usual antecedents. The ciliary processes swell and, by reason of the insufficient circumlental space, push forward the iris-base and compress the filtration angle. Obstructive phlebitis would do this, but there is no evidence that this is a common antecedent of glaucoma.

Atropine, under predisposing conditions, excites glaucoma by thickening the iris-base.

Glaucoma aggravates itself, because increasing pressure on the choroidal veins caused increases congestion of the ciliary processes and increasing compression of the filtration angle.

The anatomical predisposition and the vascular disturbance are complementary to each other in varying proportions. Acute glaucoma presents the maximum, chronic, non-congestive glaucoma the minimum of vascular disturbance.

Each of these points was then taken up separately and carefully elaborated.

SNELLEN (Utrecht), "On the treatment of glaucoma." Presented his points tersely and so arranged as to permit of but little abbreviation here.

They are therefore given in full.

From a clinical point of view, glaucoma posterius (relative overfulness of vitreous chamber) must be strictly distinguished from glaucoma anterius (relative overfulness of anterior chamber: iritis serosa, keratitis diffusa.)

In glaucoma posterius myotics tend to reopen Fontana's spaces by stretching the iris and contracting the meridional fibres of the ciliary muscle. They excite the circulation.

In glaucoma anterius myotics are prejudicial by extending the surface of the iris and by provoking pupillary adhesions.

Mydriatics act in the opposite way.

Sclerotomy is indicated in all cases of increased tension (hypertonus); it benefits by evacuating serous fluids, loosening peripheral or pupillary iris-adhesions and readmitting the impeded circulation.

The direct thrust of the iridectomy-knife involves less danger of prolapse of the iris than the cut from within outwards of the cataract-knife.

Myotics are a *sine qua non* in performing sclerotomy. The myotic contraction of the iris prevents prolapse; the contraction of the uveal tract *in toto* promotes the outflow of the fluids, and diminishes the pressure of the choroid against the sclera.

The myotic contraction of the meridional fibres of the ciliary muscle stretches Descemet's membrane, distends the inner mouth of the sclerotomy wound, and promotes the formation of new channelst to Schlemm's canal.

Excision of the iris is a subordinate part of the glaucoma-operation; but it is indicated when the iris tends to prolapse, and when the aqueous humor is retained behind the iris.

The divided sphincter of the iris stretches the iris-periphery less effectually than the undivided sphincter.

Sclerotomy without iridectomy permits repetition of operative treatment.

Impending hypertonus should interdict all straining of the accommodation.

Schoen's theory is a valuable attempt to find the primary cause of hypertonus in a function of the eye.

Although the details of Schoen's explanation seem objectionable, it may prove true, that straining of a diminished accommodation is a cause of glaucoma.

When the elasticity of the lens is lost, contraction of the circular fibres of the ciliary muscle would relax the suspensory ligament, and this relaxation would tend to a forward movement of the lens and ciliary processes.

In glaucoma perfectum exstirpation is indicated by impending pain, and because of its occasional association with intra-ocular tumor.

Extirpation is preferable to exenteration; among other reasons, in the interests of pathological examination.

SCHOEN (Leipzig), elaborated an extended theory concerning the relation between accommodative excavation and glaucoma simplex, the best part of which he has already published.

STRAUB (Utrecht), "On the choroid as an elastic organ in the normal and diseased eye." Gave the results of observations made on the eyes of animals showing this elasticity, and its probable relation to the glaucomatous process.

WAHLFORS (Helsingfors), "On intra-ocular pressure and its measurement in the human subject." This he had done by means of a manometer, and considered the tension of the normal eye to vary from three to four millimetres.

DISCUSSION.

DE WECKER, objected to the point raised by Snellen regarding the advantage of using the triangular knife. He preferred a very thin Graefe's knife instead:

ROEDER (Strassburg) made the iridectomy in cataract extractions partly as a protection against the glaucomatous changes which might follow.

PFLUEGER said that in most of the cases where glaucoma ap-

peared in early life, it was possible to discover a trace of syphilis.

LEBER (Goettingen) considered glaucoma due to inflammatory changes at the base of the iris which produced occlusion. Sclerotomy may do well, but iridectomy is a more radical method.

The discussion was also participated in by Samelsohn, Galezowski, Wicherkiewicz, Straub and Schoen.

AFTERNOON SESSION.—AUGUST 10.

M. C. HESS (Prague), "On the artificial production of cataract without rupture of the capsule." This he accomplished by subjecting rabbits to an electric shock, subsequent examination showed the opacity was due to destruction of the epithelium in the interior of the capsule.

BERNHEIMER (Heidelberg), "On the human optic chiasma." Described the manner of its embryonic growth, and showed how a few of the fibres do not cross.

Discussion by Schmitt—Rimpler, and Weiss.

HOWE (Buffalo, U.S.), "On the influence of flies in the spread of Egyptian ophthalmia." He had found Egyptian ophthalmia to be not a granular conjunctivitis as given in the books, but a conjunctivitis purulenta acuta characterized by periodicity and a remarkable tendency among the natives to corneal complications.

Whatever the starting point of the disease may be (probably gonorrhœal) he ascertained,that its propagation was largely due to the ordinary house-fly. This was shown by

1. The identity of time, the epidemic appearing every year when the flies appear, and disappearing when they grow less,

2. The identity of place. The disease being most common on the Delta and in the cities, very rare on the dessert.

3. The negligence of the natives regarding the flies (illustrated by photographs).

4. The possibility of bacteria being carried from the eye

on the feet of flies proved by plate culture (photographs of these plates shown).

5. The actual occurrence of such infection shown by cases detailed.

Morning Session.—August 11.

Leber (Goettingen), "On bacteriology in ophthalmology."

For most forms of inflammation of the eye we have to accept the theory of a mycotic origin; for some this is proven beyond a doubt. The eye being situated so near the surface of the body is most frequently attacked by microbes from without, seldom from within the body. The same kind of microbes may reach the eye by both these ways.

Certain microbes do not cause inflammation unless they come in contact with a wound, or within the tissues of the body; others excite inflammation of a lighter or severer type on an intact mucous membrane.

The purulent inflammation which follows injuries to or operations on the eyeball is, with but few exceptions, due to microbes, and is very frequently caused by the different kinds of staphylococcus and streptococcus, known to cause purulent inflammations elsewhere.

Experimental researches concerning the mycotic inflammation of the cornea, and more especially the aspergillus-keratitis, give a clear insight into the action of micro-organisms and the origin of reactive inflammation. A focus of microbes which is confined to the center of the cornea exerts a certain action *par distance* upon the nearest vascular tissue, which causes white blood-cells to emigrate into the corneal tissue and into the anterior chamber, and which can only be explained by the theory that the microbes produce certain pathogenic excretions which are diffused in a dissolved state into the surrounding tissues.

This theory receives considerable support from the fact, that a purulent inflammation may be caused by purely chemical substances, as copper or mercury; it is even proven to be cor-

rect since such substances have been extracted and isolated, for instance from pure cultures of staphylococcus.

The reaction of the body is shown first by the emigration of white blood-cells from the blood-vessels, or by their aggregating at the site of the insult. It seems that they are drawn there by the attraction exerted by the pathogenic substance which produces a paralytic condition at the site of the primary insult, by which the pus-cells lose their motility and remain lying at that place.

Further reactions which, as we know, help to remove the microbes and their products, are the phagocytosis and the softening of the invaded tissues, which we may call histiolysis, which latter brings about a demarcation and detachment of necrotic portions, and which seems to be due to a fermentative action of the pus-cells.

The growth of the microbes may, however, overcome the reaction of the body, and its progress be practically without limits.

The intense action of certain microbes growing on the intact conjunctiva (gonococcus and diphtheritic contagion) can also be explained by the assumption that the microbes produce chemical substances which, like the *phlogosine* which has been isolated from the staphylococcus, affect even a healthy conjunctiva.

To determine the manner in which the different microbes act which are found in diseases of the conjunctiva and cornea, much close observation is yet wanting.

I do not doubt that the non-traumatic inflammatory processes of the interior of the eyeball are due to noxious substances brought there by the circulation of the blood, and are in most cases of a microbic origin. We must, however, differentiate between embolisms of septic material or simple adhesion to the wall of the blood-vessel of microbes which circulate in the blood.

The distribution of microbes by the lymph-stream is less frequent. The so-called sympathetic ophthalmia, most probably, is a microbic inflammation traveling to the second

eye by means of the lymphatic spaces of the sheaths of the optic nerve.

The same explanation holds good for the propagation of a microbic infection from the orbit into the sinus cavernosus along the sheath of the abducens nerve after enucleation of the eyeball. Herpes zoster, perhaps, is caused by the migration of a microbic neuritis to the surface of the body.

An injury to the ciliary body in itself does not harbor the danger of sympathetic ophthalmia ; the latter is due solely to the infection of the wound which it may be very difficult to recognize.

Foreign bodies within the eyeball, especially copper, may cause a purulent inflammation without microbes. The diagnosis can easily be verified by culturing the pus. In such cases the extraction of the foreign body may save the eye, and sometimes a portion of its vision, without detriment to the fellow-eye.

Sattler formulated his views on bacteriology in ophthalmology in the following manner:

1. GROUP.—Mycotic diseases of the eyeball in which the pathogenic germs attack the tissues through an intact surface:

a. Acute blenorrhœa of the conjunctiva. The gonococcus produces an intensely active chemical poison which enables it to enter the tissues and causes the intense symptoms of inflammation.

b. Trachoma. In this disease local and individual conditions are of especial importance. The microbe has not yet been undoubtedly demonstrated.

c. Croup and diphtheria of the conjunctiva. The pathogenic germ is as yet unknown. It seems, however, to produce a very active chemical poison, which is able to kill the epithelium of the mucous membrane, and even its superficial layers.

d. Acute infectious catarrh. Weeks' bacilli, pyogenous staphylococci are almost never wanting in the secretion.

Non-pathogenic microbes in the conjunctival sac. A certain coccus which is similar to the staphylococcus pyogenes albus and the so-called xerosis-bacillus.

2. GROUP. Bacterial affections, in which a surface-lesion is necessary for the entrance and the development of the pathogenic germs:

a. Primary syphilitic induration of the conjunctiva.

b. Tuberculosis of the conjunctiva.

c. Purulent processes.

But very small quantities of pus-cocci are necessary to cause suppuration of the conjunctiva. When a purulent process is produced by a foreign body, it is less due to the microbes which cling to the foreign body than to those present within the conjunctival sac or on the fingers. Among the microbes found in the earth of the fields no pyogenous microbes were detected.

There are, also, some few kinds of bacteria which produce a progressive purulent inflammation.

There are some kinds of bacteria which can cause suppuration which has, however, no tendency whatever to progress. A typical bacterium of this kind is the so-called micrococcus prodigiosus.

Even some chemical substances may produce a purulent inflammation, but without the faculty to progress. Among these are some nitrogenous organic substances, and especially mercury. Other irritating substances, as oil of turpentine, croton oil, etc., do not produce pus, but a fibrinous exudation.

3. GROUP. Mycotic diseases in which the pathogenic substance is carried into the eye by the blood or lymph.

Certain purulent processes within the eyeball can be explained by the metastasis. Pus-bacteria which are carried away by the blood-stream from some place of the body may be retained within the eyeball, if there is a local obstacle to the circulation in the eye, as for instance, a thrombosis in a localized area, etc.

Pus-bacteria cannot be the cause of sympathetic ophthalmia. A micrococcus found by the author seems to be the probable ætiological factor.

CHIBRET (Clermond-Ferrand), bacteriological studies to determine an exact antisepsis in ophthalmology. Found that

the oxycyanide of mercury is better than the bichloride in being more stable, readily soluble, not acid, does not percipitate albuminoids nor corrode instruments so easily. As an antiseptic it is to the bichloride in strength as 14 is to 13.

Discussion.

Knapp considered complete antisepsis of the eye almost impossible, except by means of the heated wire. He referred at length to the readiness with which an eye could be infected with the discission needle, and cautioned against it.

Further discussion by Deutschmann, Schmitt—Rimpler, Samelsohn, Meyer, Leber and Stilling.

Afternoon Session.—August 11.

Dr. Mazza-Andrea (Genoa), attempted to produce sympathetic ophthalmia by causing the staphylococcus pyogenes aureus to pass from one eye to the other, but with only negative results.

Dr. Dor (Lyons), "On coloboma of the upper lid." Had collected 56 cases from the literature and gave an analysis of them.

Discussion by Drs. Nuel (Liège), Weiss and Dor.

Knapp (New York), "On Determination of the meridian of cylindrical glasses." Pointed out the great advantage of a common nomenclature in this respect. Proposed to call the top of the vertical meridian o, and indicating the inclination toward the nasal side by *n*, and toward the temporal side by *t*.

Haab (Zuerich), "On alterations of the macula, with a series of representations of the various changes."

Discussion by Becker, Knapp and Nuel.

Landolt.—A more useful method of numbering prisms. He proposed that this should be not according to the angle at which they are made, but in proportion to the amount of deviation they actually produce—(the angle of miminum deviation). In that way a prism of a certain degree would

correspond to a certain amount of deviation of the eye or the reverse.

The time allotted for papers having expired, discussion began on the next place of meeting, resulting in the choice of Edinburgh in the year 1894.

After a few appropriate words from the President, Donders, the Congress adjourned.